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# The Federated Universal Content Distribution Network

aka The Intelligent Internet

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AUTHOR: Rhett Sampson

## The Problem with OTT Video

*In becoming a 150 billion dollar behemoth, Netflix has created a category, and a monster. In transforming from a challenger to a category killer, it has spawned other aspirational monsters: Disney+; Paramount+; AppleTV; Hulu; ESPN+; Amazon Prime; Google Play; HBOmax. But there is a fly in the ointment.*

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**These video monsters are consuming their creators and the Internet.**

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What do all of these have in common, apart from video? They **all** run their own Over The Top (OTT) video distribution platforms, in some form. These platforms run on parallel-but-separate, expensive, highly-duplicated, inefficient, network islands. Never talking to each other. Overloading the public Internet and often using telco networks for free, sparking massive industry debates such as Net Neutrality and Fair Share. Costing their owners billions and making what should be a highly profitable new category unprofitable. The good news is, there is a solution.

## A Solution that Worked for a While

Content Distribution Networks (CDNs) such as Akamai, Edgio, Cloudflare and Fastly sprang up to try and solve this problem; but no single telco, CDN or OTT network can solve this on its own. It is beyond the resources of a single-application business model. Even multi-CDN isn't working. To say nothing of the requirements of virtualisation and sub-msec, edge compute applications such as XR, industrial automation and AI. It requires the funding, assets, resources, and co-operation of businesses built over a century for big capex and multiple networks **directly** connected to consumers in the last mile, but with a new, 21<sup>st</sup> century, content distribution model.

## The Only Real Solution

Forward thinking telco, CDN and Internet operators and researchers agree on a number of promising characteristics for the next generation of the Internet:

1. Content centric (aware of what content it is carrying and why)
2. Converged infrastructure (caching and processing throughout the network)
3. Virtualised and elastic
4. Connectionless at the network level
5. Intelligent, both locally and globally
6. Autonomous and
7. Self-optimising
8. Running a unified protocol that scales
9. On a unified, open, switch/server platform
10. And..... (next page)

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10. And, most importantly, it must be a *federated network of intelligent networks*. That is, a Universal Content Distribution Network that forms *the Intelligent Internet*.

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## SO, WHAT DOES THAT LOOK LIKE, AND HOW DO WE ACHIEVE IT?

### CONTENT CENTRIC

TCP/IP is as dumb as a rock. To support video content at scale and acceptable QoS, along with next gen apps such as XR, IoT and AI, the Internet must understand what it is carrying, who for, and why. Initiatives such as Content Centric Networking (CCN), Information Centric Networking (ICN), and Name Domain Networking (NDN) have pioneered this concept. SPAN takes it to a whole new level.

### INTELLIGENCE

Once you make that fundamental change to Information Centric Networking, many things become possible. The most important is the ability to apply AI, specifically Machine Reinforcement Learning (MRL) and Stochastic Optimisation (SO or “fuzzy logic”) to content routing, switching, storage and operations. This enables the *network* to make intelligent routing and caching decisions and to become autonomous and self-optimising.

Because the network is self-aware and AI aware, it is able to optimise its configuration and operation for demanding AI based applications. As AI models grow exponentially in complexity, and the search intensifies to unify them into generative AI, the network must be able to support that evolution. SPAN-AI architecture includes global AI training, optimisation, and distribution. It also includes the ability to contribute standalone, new AIs for specific applications in the network. This will form an “AI marketplace” that will contribute to the “democratisation” of AI.

### INTEROPERABLE

All networks must be interoperable. The initial approach of the early Internet was to achieve this by making the operating protocols as simple as possible. This was because CPUs and memory were very expensive and rare. That is no longer the case, and newer, distributed, switch/server architectures with pooled memory are making it even less so. This enables network nodes to be much smarter, learning and optimising routing and operations as they go. State-of-the-art modelling has shown that this must be at two levels: local and global. Counterintuitively, instead of complicating inter-operation, this simplifies it. All that is required are three API inter-connects:

1. SPAN-AI switch routing API
2. SPAN-AI operations API
3. SPAN-AI global API

Because these are AI APIs, they are very sophisticated compared with, say, BGP. This will create the Intelligent Internet, a network of intelligent networks. It also provides the foundation to allow any telco, Content Distribution Network, or even end user device, running SPAN, to provide virtual services anywhere in the world over the inter-connected fabric of SPAN containerised micro-services. The distinction between server and network disappears, and the network becomes the cloud™.

## SO WHAT DOES THIS REQUIRE?

### ZERO KNOWLEDGE/TRUST PROOFS

It is essential that whoever contributes resources is paid. Drawing on the foundation innovations of Web 3 and the blockchain, we will use two zero knowledge proofs:

1. Proof of storage over time against QoS
2. Proof of switch/routing

These proofs will be efficient and useful, ensuring that SPAN is an efficient network in terms of both financial cost and planetary resources. It means that anyone can provide services to the network and get paid for them. We will use digital tokens as payment with efficient layer 2 accounting protocols. Feedback will be provided to operators to enable improvement of service utility and optimisation of revenue. Our distributed storage architecture uses name-based methods overlaid with name-resolution methods as backup and fallback layers. This ensures highly efficient retrieval and reliable distribution of content stored in the network.

## WHAT DOES THIS MEAN FOR EVERYONE?

The Intelligent Internet will be very different from the current legacy Internet. The network becomes the computer and the cloud. It is aware and accepts instructions. Computation and storage are fully distributed. The simplest and most fundamental of these new instructions are “PUBLISH” and “SUBSCRIBE”. Content producers and owners will publish **one** premium encode, once, **to the network**, with a Quality of Service (QoS) specification. The *network* will take care of storage and distribution, ensuring QoS is met. Consumers will subscribe to a piece of content, anywhere, by name, ideally via a unified interface. The network will retrieve it, within specified QoS parameters, and make intelligent routing and caching decisions as it does so.

### Many more BENEFITS then become possible:

- ✓ On-demand and live video broadcast/multicast become inherent in the network.
- ✓ Users experience a **single** on-demand User Interface (UI) with global content brands at the top level and their respective catalogues underneath (see example below).
- ✓ Global usage and performance statistics are available to all.

- ✓ Global content search and discovery becomes possible.
- ✓ Optimised content deals for smaller producers ensure fair use and revenue.
- ✓ Improved content communities increase revenue by adding real value.

## THE FEDERATION

The published AI APIs, autonomous agents, and global optimising AI, make federation of SPAN-AI networks relatively easy and very effective. Zero knowledge proofs ensure that everyone who contributes resources gets paid. The richness of the AI APIs ensures high levels of operational and routing information are held on a network wide basis. The Universal Content Distribution Network operates as a single, homogeneous network with sophisticated operational management and optimisation, with no central point of management or failure.

The SPAN architecture, combined with intelligent, content-based routing, ensures that the network can meet next gen application service levels and loads consistently across the network. Comprehensive network data enables real time and forecast optimisation of virtual network resources to meet QoS. The network reconfigures itself to meet demand.

Content owners and publishers get a global, studio quality, universal distribution network and user interface that aggregates and optimises content. Publishers retain control of the customer, payment, and the quality of service, optimising the experience for the customer. Use of global networks is rebalanced fairly on a user pays basis at reasonable cost. Operating costs are significantly reduced, and quality is optimised.

Our North American telco PoC partner will show the way for other tier one telcos to join the federation and the benefits of doing so. Our potential CDN partner is already working with the PoC telco, many others, and most of the Hollywood studios. The PoC telco has close working relationships with a major global datacentre operator and other tier one telcos. The Laser Light Communications global satellite network is the final piece that will give us a next gen Internet architecture and critical mass.

## SECURITY

Security is engineered into SPAN-AI from the ground up. High value content is encrypted at ingest and remains encrypted in motion and at rest. All content packets are signed by the publisher to ensure authenticity and origin. Identity is sovereign and verified at the edge for consumers and publishers. This enables sovereign data ownership.

## GLOBAL ECONOMIC IMPACT

The SPAN UCDN will improve the efficiency of the content business and make it profitable, especially “OTT” on-demand and live video. It will deliver studio quality, 8K video and above, anywhere in the world, with no dropped frames, for a reasonable cost. It will make telcos “whole” again, returning revenue lost to CDNs decades ago. It will ensure survival of next gen CDNs that share our vision and technology and provide real

value. It will improve the efficiency of datacentres, servers and networks; both internal and consumer; tightly coupling applications to users.

## CONCLUSION

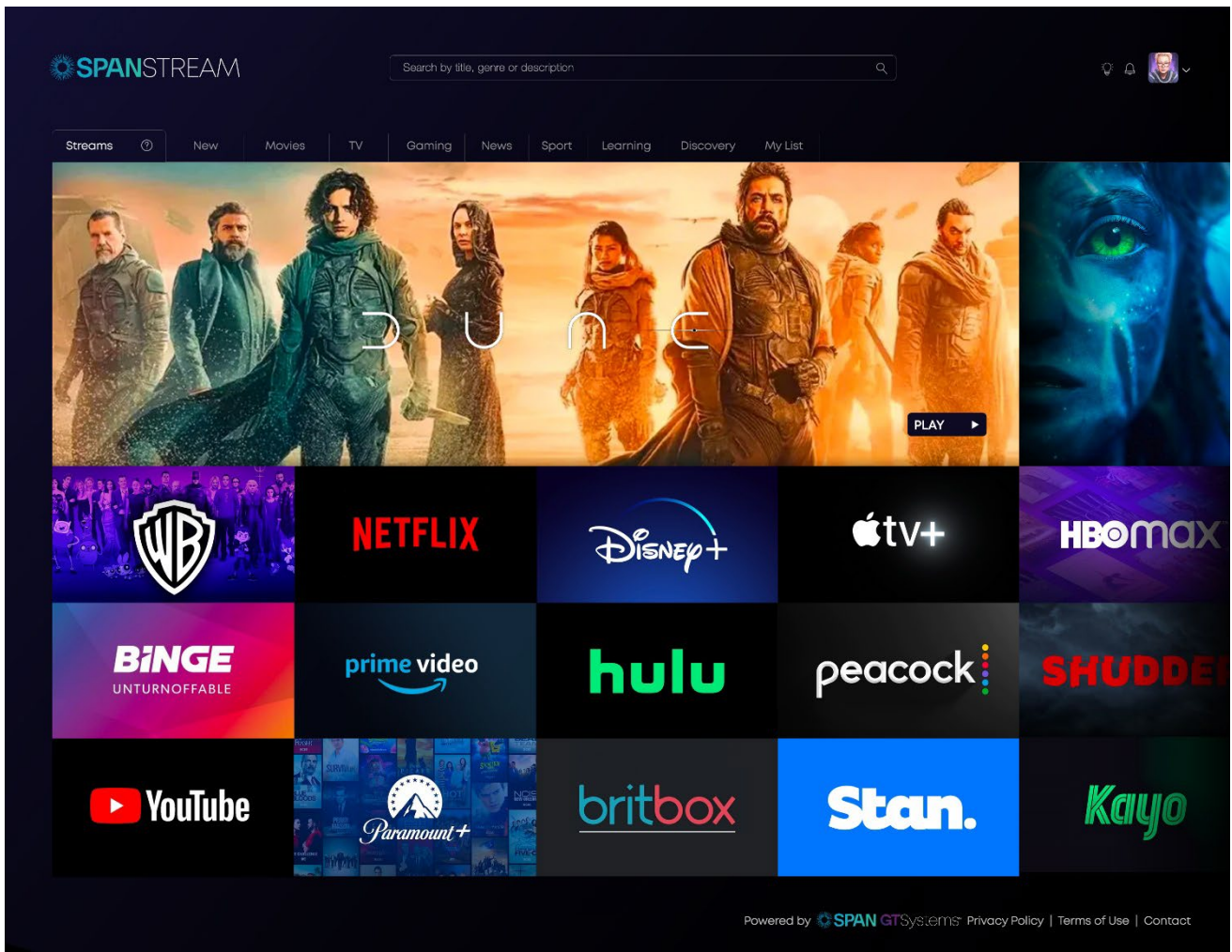
SPAN-AI will not only slay the OTT distribution monsters, it will usher in the next Internet age of XR, IoT, generative AI and quantum computing, on earth and in space. Quantum computing is in its early days, but its backbone must be a secure laser network which we are building with Laser Light Communications. The SPAN federated Universal Content Distribution Network makes all this possible.

## NEXT STEPS

1. We have reached agreement for a PoC pilot of the SPAN UCDN with one of the largest telcos in North America. They have close working relationships with many global tier 1 telcos who they can bring to the network.
2. We are in discussions with a leading next gen CDN. We share the same fundamental innovation and SPAN adds significant value to their network.
3. Laser Light Communications are doing their final capital raise. We have a letter of intent with them for a pilot and significant funding.
4. We are working with Intel on their next gen switch/router platforms.
5. We are in discussions with datacentre, NaaS, network equipment and server vendors.
6. We are reaching out to major content owners and publishers to participate in the PoC.
7. The PoC demos will include Information Centric Networking switching, the distributed origin store and a universal user interface.
8. The PoC also includes production of an MVP demonstrating distribution of premium content via ICN switching, the distributed origin store and a universal user interface.
9. Followed by full production versions of SPAN-AI
10. And growth to cover the whole market.

See User Interface mock-up and future network diagram next pages.

## The SPANstream™ user interface



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Future network architecture

